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 Geometry

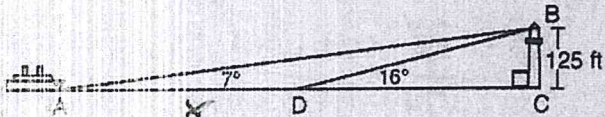
Compound Right Triangle Problems
Common Core Geometry Common Part III

Compound Right Triangle Problems

Procedure 1: **Subtraction:** Find corresponding parts of the two triangles and subtract them.

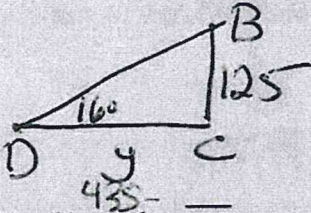
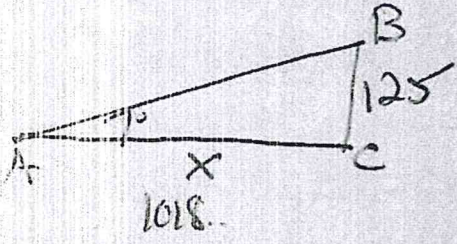
Procedure 2: **Reflexive:** Find a side/angle that's in both triangles. Use that new side/angle to find what you are looking for.

1. As shown in the diagram below, a ship is heading directly toward a lighthouse whose beacon is 125 feet above sea level. At the first sighting, point A, the angle of elevation from the ship to the light was 7° . A short time later, at point D, the angle of elevation was 16° . To the nearest foot, determine and state how far the ship traveled from point A to point D.



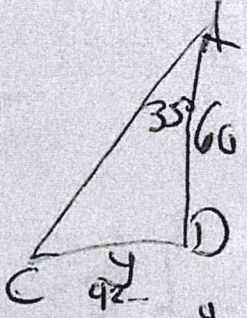
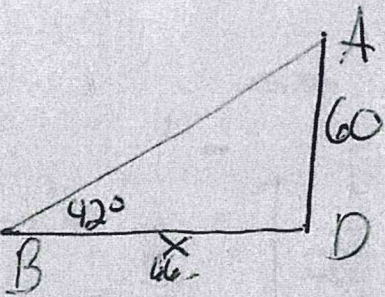
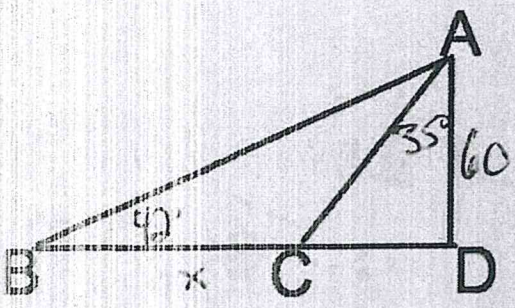
$$\begin{aligned} \tan 7 &= \frac{125}{x} \\ \cdot 1.127 &= \frac{125}{x} \\ \cdot 1.127x &= 125 \\ \frac{1.127x}{1.127} &= \frac{125}{1.127} \\ x &= 1018 \end{aligned}$$

$$\begin{aligned} \tan 16 &= \frac{125}{y} \\ \cdot 2.867 &= \frac{125}{y} \\ \cdot 2.867y &= 125 \\ \frac{2.867y}{2.867} &= \frac{125}{2.867} \\ y &= 435 \end{aligned}$$



$$1018 - 435 = 582 \text{ ft}$$

2. In the diagram below, $m\angle CAD = 35^\circ$, $m\angle ABD = 42^\circ$, and $m\angle AD = 60$. Find to the nearest tenth, $m\overline{BC}$.



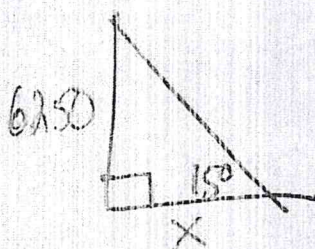
$$60 - 42 = 18$$

24.6

$$\begin{aligned} \tan 42 &= \frac{60}{x} \\ \cdot 9004 &= \frac{60}{x} \\ \cdot 9004x &= 60 \\ \frac{9004x}{9004} &= \frac{60}{9004} \\ x &= 66 \end{aligned}$$

$$\begin{aligned} \tan 35 &= \frac{60}{y} \\ \cdot 7002 &= \frac{60}{y} \\ \cdot 7002y &= 60 \\ \frac{7002y}{7002} &= \frac{60}{7002} \\ y &= 42 \end{aligned}$$

3. Freda, who is training to use a radar system, detects an airplane flying at a constant speed and heading in a straight line to pass directly over her location. She sees the airplane at an angle of elevation of 15° and notes that it is maintaining a constant altitude of 6250 feet. One minute later, she sees the airplane at an angle of elevation of 52° . How far has the airplane traveled, to the nearest foot?

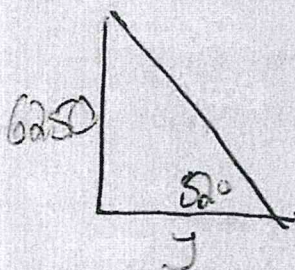


$$\tan 15 = \frac{6250}{x}$$

~~$$x = \frac{6250}{\tan 15}$$~~

$$\frac{26719}{.26719} = \frac{6250}{.26719}$$

$$x = 23325.$$



$$\tan 52 = \frac{6250}{y}$$

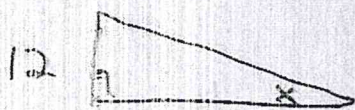
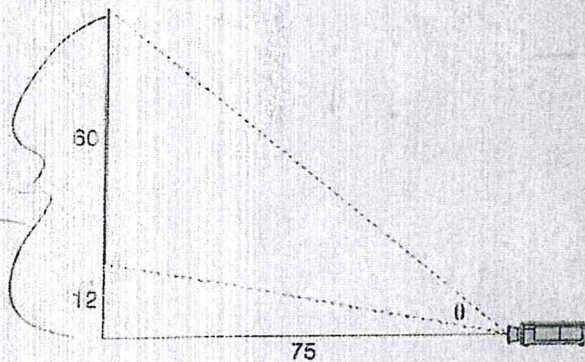
$$\frac{1.2799}{1} = \frac{6250}{y}$$

$$\frac{1.2799y}{1.2799} = \frac{6250}{1.2799}$$

$$y = 4883.$$

$$23325 - 4883 = 18442 \text{ ft}$$

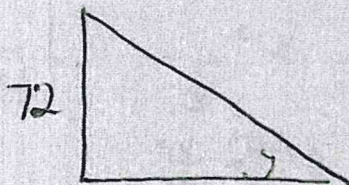
4. As modeled below, a movie is projected onto a large outdoor screen. The bottom of the 60-foot-tall screen is 12 feet off the ground. The projector sits on the ground at a horizontal distance of 75 feet from the screen. Determine and state, to the nearest tenth of a degree, the measure of θ , the projection angle.



~~$$\tan x = \frac{12}{75}$$~~

$$x = \tan^{-1} \frac{12}{75}$$

$$x = 9.09$$



$$\tan^{-1} \frac{72}{75} = \tan^{-1} \frac{72}{75}$$

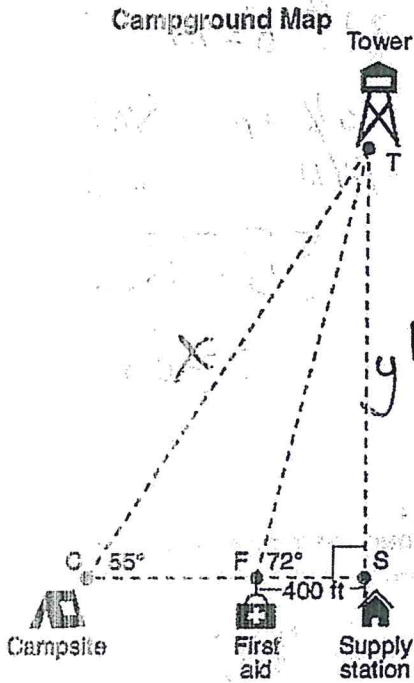
$$y = \tan^{-1} \frac{72}{75}$$

$$y = 43.83$$

$$43.83 - 9.09$$

$$\theta = 34.7$$

5. The map of a campground is shown below. Campsite C , first aid station F , and supply station S lie along a straight path. The path from the supply station to the tower, T , is perpendicular to the path from the supply station to the campsite. The length of path \overline{FS} is 400 feet. The angle formed by path \overline{TF} and path \overline{FS} is 72° . The angle formed by path \overline{TC} and path \overline{CS} is 55° . Determine and state, to the nearest foot, the distance from the campsite to the tower.



ST is a side in both triangles

$$\tan 72 = \frac{y}{400}$$

$$3.0777 = \frac{y}{400}$$

$$y = 1231$$

$$\sin 55 = \frac{1231}{x}$$

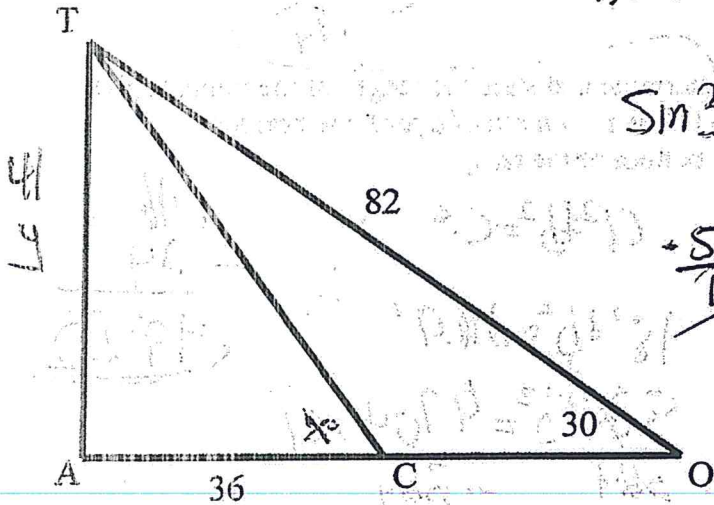
$$.8192 = \frac{1231}{x}$$

$$.8192x = 1231$$

$$\frac{.8192x}{.8192} = \frac{1231}{.8192}$$

$$x = 1503$$

6. Find the measure of $\angle TCA$ in the diagram of right triangle TAO below to the nearest tenth of a degree.



TA is a side in both triangles

$$\sin 30 = \frac{y}{82}$$

$$\frac{.5}{1} = \frac{y}{82}$$

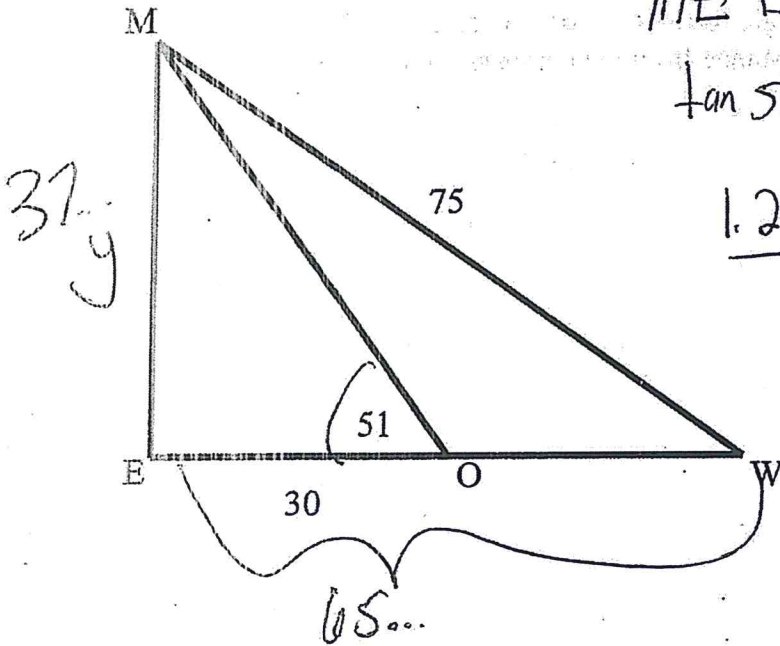
$$y = 41$$

$$\tan x = \frac{41}{36}$$

$$x = \tan^{-1} \frac{41}{36}$$

$$x = 48.7^\circ$$

7. Find the measure of \overline{OW} in the diagram of right triangle MEW below to the nearest unit.



\overline{ME} is in both triangles

$$\tan 51 = \frac{y}{30}$$

$$\frac{1.2349}{1} = \frac{y}{30}$$

$$y = 37$$

$$a^2 + b^2 = c^2$$

$$37^2 + b^2 = 75^2$$

$$1372 + b^2 = 5625$$

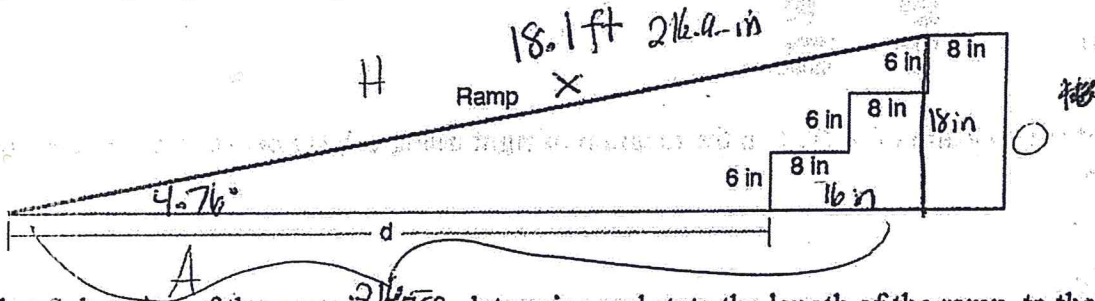
$$-1372 \quad -1372$$

$$\sqrt{b^2} = \sqrt{4252}$$

$$b = 65$$

$$65 - 30 = 35$$

8. As modeled in the diagram below, an access ramp starts on flat ground and ends at the beginning of the top step. Each step is 6 inches tall and 8 inches deep.



If the angle of elevation of the ramp is 4.76° , determine and state the length of the ramp, to the nearest tenth of a foot. Determine and state, to the nearest tenth of a foot, the horizontal distance, d , from the bottom of the stairs to the bottom of the ramp.

$$\sin 4.76 = \frac{18}{x}$$

$$0.0830 = \frac{18}{x}$$

$$0.0830x = 18$$

$$\frac{0.0830x}{0.0830} = \frac{18}{0.0830}$$

$$x = 216.9 \text{ in} \cdot \frac{1 \text{ ft}}{12 \text{ in}} = 18.1 \text{ ft}$$

$$a^2 + b^2 = c^2$$

$$a^2 + 18^2 = 216.9^2$$

$$a^2 + 324 = 47051$$

$$-324 \quad -324$$

$$\sqrt{a^2} = \sqrt{46727}$$

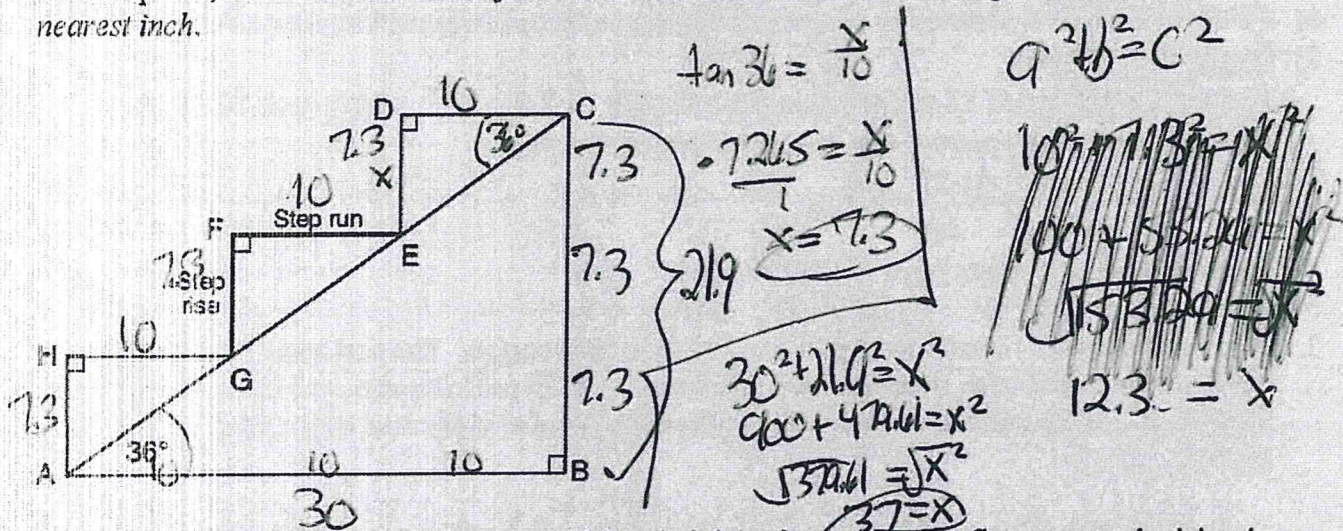
$$a = 216$$

$$216 - 16 = 200 \text{ in}$$

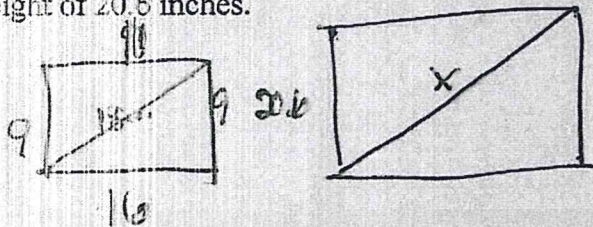
$$200 \text{ in} \cdot \frac{1 \text{ ft}}{12 \text{ in}} = 16.7 \text{ ft}$$

9. A homeowner is building three steps leading to a deck, as modeled by the diagram below. All three step rises, \overline{HA} , \overline{FG} , and \overline{DE} , are congruent, and all three step runs, \overline{HG} , \overline{FE} , and \overline{DC} , are congruent. Each step rise is perpendicular to the step run it joins. The measure of $\angle CAB = 36^\circ$ and $\angle CBA = 90^\circ$.

If each step run is parallel to \overline{AB} and has a length of 10 inches, determine and state the length of each step rise, to the nearest tenth of an inch. Determine and state the length of \overline{AC} , to the nearest inch.



10. The aspect ratio (the ratio of screen width to height) of a rectangular flat-screen television is 16:9. The length of the diagonal of the screen is the television's screen size. Determine and state, to the nearest inch, the screen size (diagonal) of this flat-screen television with a screen height of 20.6 inches.



Handwritten calculations for problem 10:

$$a^2 + b^2 = c^2$$

$$9^2 + 16^2 = c^2$$

$$81 + 256 = c^2$$

$$\sqrt{337} = c$$

$$18.357 = x$$

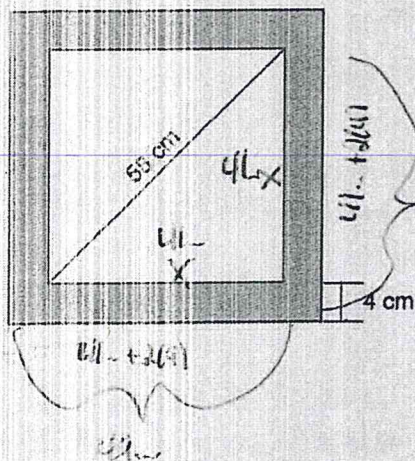
$$\frac{9}{16} = \frac{18.6}{x}$$

$$\frac{9x = 378}{9}$$

$$x = 42$$

11. Keira has a square poster that she is framing and placing on her wall. The poster has a diagonal 58 cm long and fits exactly inside the frame. The width of the frame around the picture is 4 cm.

Determine and state the total area of the poster and frame to the nearest tenth of a square centimeter.



Handwritten calculations for problem 11:

$$a^2 + b^2 = c^2$$

$$x^2 + x^2 = 58^2$$

$$\frac{2x^2 = 3364}{2}$$

$$\sqrt{x^2} = \sqrt{1682}$$

$$x = 41$$

Handwritten calculations for problem 11:

$$A = lw$$

$$A = 49 \cdot (49)$$

$$A = 2402.2$$